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CHEMICAL & ENGINEERING NEWS

C&EN

APRIL 18, 1994

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CHEMICAL & ENGINEERING NEWS

C&EN

APRIL 18, 1994

NEWS OF THE WEEK

■ University of Kentucky researchers propose a new mechanism for Alzheimer's disease—that the nerve cell damage is caused by free radicals generated from the breakdown of β-amyloid peptide. **Page 4**

■ A catalytic route to directly convert methane to acetic acid has been developed by Penn State chemists. **Page 5**

■ 3M, Union Carbide, and three small companies agree to join the global silicone breast implant settlement. **Page 5**

■ A program is launched to increase the number of blacks working toward doctorate degrees, especially in science and engineering. **Page 6**

■ The Army tells Congress it plans to continue to implement its $9 billion incineration program to destroy the U.S.'s stockpile of chemical weapons, calling alternative technologies incapable of meeting requirements. **Page 7**

■ House subcommittee renews its scrutiny of scientific misconduct, members charge scientific community with inadequate responses to fraud in cancer study. **Page 7**

COVER: Computer-graphic image of the surface of a thin-film, high-T_c superconductor generated by Melvin L. Prueitt, Los Alamos National Lab, using STM data supplied by Marilyn E. Hawley, Ian D. Raistrick, and Jerome G. Beery

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Chemical & Engineering News
1155—16th St., N.W., Washington, D.C. 20036

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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-4432
John Kistler Crum, Executive Director
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PUBLISHING BOARD: Joseph A. Dixon *(Chairman); Board of Directors Chairman:* Paul H. L. Walter; *President:* Ned D. Heindel; Paul S. Anderson, Richard L. Deming, Paul W. Jennings, Barbara J. Peterson

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Subscription Rates 1994: Printed editions: nonmembers U.S. 1 yr. $115, 2 yr. $207; outside U.S. 1 yr. $152, 2 yr. $281. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3–10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $18. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to C&EN, Member & Subscriber Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

Advertising Management: CENTCOM LTD.
(For list of offices see page 64)
Office of Ombudsman: (800) ACS-5558, No. 5–4
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LETTERS

Organochlorine drugs

As a naive, occasional beneficiary of pharmaceutical drugs, I have a simple question to ask: What will happen to the dozens of chlorine-containing medicines if chlorine and all chlorinated chemicals are summarily banned becase of suspected toxicity of a few organochlorines—as is being proposed by Greenpeace, the Environmental Defense Fund, and assorted environmental juntas? Does Greenpeace have substitutes for Claritin, Ultravate, Elocon, Mepron, Almide, Wellbutrin, Femstat, Lopidine, Selepam, Melex, Bonefos, Aclovate, Fareston, Proendotel, Propulsid, Halfan, and Sporanox—all of which contain chlorine.

These specific organochlorine pharmaceuticals are used to treat millions of Americans annually for depression, arthritis, fungal diseases, glaucoma, inflammation, psoriasis, allergies, infections, osteoporosis, ulcers, malaria, coronary disease, and cancer. What will happen to the millions of American children who develop severe middle-ear infections and are now best treated with the chlorine-containing antibiotics Ceclor and Lorabid if these drugs are banned?

Of the nearly 400 new drugs approved for therapeutic use in humans since 1984, more than 60 are organochlorine compounds. Two of the 10 most prescribed pharmaceuticals, Ceclor and Xanax, contain chlorine. How does Greenpeace plan to replace the dichloro-containing vancomycin—the only antibiotic effective against hospital staph infections? Or Losartan, the new DuPont-Merck drug for hypertension, or the two clinical candidate drugs CI-1002, the Parke-Davis agent for Alzheimer's disease, and NE-10064, the new Procter & Gamble antiarrhythmic drug? All of these are organochlorine compounds and are perfectly safe.

Gordon W. Gribble
Department of Chemistry
Dartmouth College
Hanover, N.H.

Literacy is already defined

Frank X. Sutman (C&EN, March 28, page 2) accuses James Trefil (C&EN, March 14, page 26) of scientific elitism for suggesting that the public should be better informed on matters scientific. Not to be outdone, Sutman then proceeds to rewrite the dictionary on the definition of literacy, surely an elitist maneuver if there ever was one.

Literacy, the state of being literate, has (at least up to this time) meant the ability to read, write, and presumably to understand what was written or read. Literacy as a "willingness to learn" is just the sort of dumbing down that is going on in the schools today. Equal weight cannot be given to knowledge attainment and attitude development without hopelessly confusing the educational process. The plain facts are that most high school graduates have a good attitude but can't write a simple descriptive paragraph. This means that they are illiterate and no level of redefinition can change that.

James A. Gallagher
Grosse Ile, Mich.

Benefits of eye protection

Letters to the editor by Jay A. Young and John M. Hoffman (C&EN, Feb. 7, page 3) deal with legalities that do not require the wearing of eye protection "when nothing dangerous is going on." A followup by Malcolm M. Renfrew (C&EN, March 21, page 2) noted the liability of management should an accident happen in a supposedly non-accident-sensitive laboratory situation. I would like to address the potential "victim's" perspective.

As a graduate student at Brooklyn Polytech, many years ago, I was in the process of scraping out a crystalline precipitate from the bottom of a beaker, using a glass rod to dislodge the precipitate. A nonhazardous situation? I have never felt dressed in a laboratory without my safety glasses. Fortunately, my glasses were right where they were supposed to be.

The precipitate was unyielding and the glass rod broke in half, the bottom end tumbling upward, end over end, with considerable force. The broken end of the rod directly impacted, end on, onto one eyeglass face with such force that my head was jarred backward. Fortunately, the glass lens held intact and I was spared who knows what pain, heartache, and anguish. Don't tell me there are situations in the laboratory "when nothing dangerous is going on."

Patrick V. Bonsignore
Argonne National Laboratory
Argonne, Ill.

Correction

• April 4, page 9: Enzon's net loss for the fiscal year ending June 30, 1993, was $24.6 million, not $78.9 million, which is the company's cumulative loss since its inception in September 1981.

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tlement is joined by General Electric, which supplied silicone materials to implant makers, and by some smaller suppliers.

Judge Sam C. Pointer Jr. of the U.S. District Court of Alabama in Birmingham must give preliminary approval to the five companies' settlement offers. Pointer must then notify women affected by the settlement and hold a fairness hearing, after which he may give his final approval. Pointer has jurisdiction over all federal breast implant suits.

Of the five firms, 3M will make the largest contribution, $325 million. The diversified chemicals and materials manufacturer owned McGhan Medical Corp., a small manufacturer of breast implants, between 1977 and 1984. In March, a Houston jury ordered 3M and McGhan to pay about $30 million in a breast implant lawsuit (C&EN, March 14, page 8). But a 3M spokesman calls it a coincidence that the company is joining the settlement so soon after it lost the suit. McGhan also will join, contributing $25 million.

Union Carbide will make the second largest contribution of the five firms, $138 million. It did not make implants but supplied what it calls generic bulk silicone materials to the industry. Two other small silicone materials makers will join the settlement: Wilshire Foam Products (providing $8 million) and Applied Silicone Corp. ($225,000).

Marc Reisch

Program aims to boost number of black Ph.D.s

A new program designed to increase the number of blacks working toward doctorate degrees—especially in science and engineering—was announced at a press conference in Washington, D.C., last week by the National Association of State Universities & Land-Grant Colleges (NASULGC) and the American Association of State Colleges & Universities (AASCU).

A key element in the National Minority Graduate Feeder Program is to identify promising undergraduates in their junior and senior years at 38 historically black public colleges and universities and to enter their names into a national computerized database. Launched with a $119,000 grant from the General Electric Foundation, the database will match these outstanding students with doctoral degree-granting universities that are members of NASULGC and AASCU. These two organizations have more than 500 institutions eligible to participate; the first-year goal is to enlist at least 20 to 30 schools in the program.

Each institution must agree to establish 10 Ph.D. fellowships or teaching assistantships specifically targeted to these students. Schools also will be required to identify faculty members to implement and monitor the program on campus, to ensure that proper mentoring takes place.

"Our goal for the first full year of the program is to identify as many as 700 students majoring in engineering, computer science, chemistry, biology, physics, and mathematics," says Frederick S. Humphries, president of Florida A&M University and chairman of the board of directors of NASULGC.

"By drawing from this pool, before too long we should be able to change [a] disgraceful fact," Humphries stresses: In 1992, American universities awarded just 13 Ph.D. degrees in chemistry to black U.S. citizens (out of more than 2,000 chemistry doctorates); only seven Ph.D.s in physics and astronomy; four each in mathematics and computer science; and six in earth, atmospheric, and marine sciences. Even more alarming, the Florida educator adds, is that the number of blacks earning Ph.D.s declined between 1991 and 1992.

Humphries, a physical chemist, has long contended that the extreme underrepresentation of blacks in U.S. graduate schools reflects a lack of university leadership (C&EN, Sept. 13, 1993, page 48). Although no financial goals have been set for the program, Humphries says,

C&EN staff photo

Humphries: to change a disgraceful fact

"We decided not to say we needed $7 million or $10 million to start acting. The problem is too important to wait." When fully operational, the program plans to raise money from corporations and philanthropies to provide fellowships to juniors and seniors to help support them prior to graduate school.

Several university presidents praise the new program. Typical is the comment of Purdue University president Steven C. Beering: "Because this proposal brings together the collective force of two major associations and ... some of our nation's very strongest graduate education programs, it has the potential to impact minority groups more than any single institution or geographically linked consortia of universities may be able to do."

At a minimum, the database will contain information on a student's academic discipline, grade point average, and Graduate Record Exam scores that can be accessed by participating universities. "Most of these schools also have summer research programs for undergraduates," explains Humphries, "and we anticipate that a lot of these universities will use the database to get an early 'look-see' at the most promising students."

Madeleine Jacobs

Number of doctoral degrees in the sciences received by blacks remains low

Black doctorates[a]	1992	1991	1990	1980	% change 1991–1992
Total, all disciplines[b]	961	1,003	898	1,031	–4.2%
Physical sciences	34	40	27	25	–15.0
Chemistry	13	18	14	10	–27.8
Engineering	32	43	28	11	–25.6
Chemical	8	4	4	0	100.0
Life sciences	87	88	73	65	–1.1

a Includes U.S. citizens only. b Includes physical sciences, engineering, life sciences, social sciences, humanities, education, and professional (other fields). **Source:** National Research Council, "Survey of Earned Doctorates, 1992"

PET Resins Maintain Strong Growth Despite Market Challenges

■ ***Producers of widely used plastic for bottles face increasing pressure to develop new grades and add capacity***

Susan J. Ainsworth, C&EN Houston

Polyethylene terephthalate (PET) resins have been a bright spot in the plastics business, which has generally been in the doldrums over the past few years.

In particular, the 2.1 billion-lb-per-year merchant market for PET resins in the U.S., which includes sales of PET resin to customers who make final products like bottles and thermoformed trays, is growing at a rate of 11.5% per year, according to Terry L. Persinger, general manager for PET at Shell Chemical in Houston.

Demand for PET resin has remained high since the plastic first appeared on the market in 1977, says Persinger, simply because "it makes a great package. The carbonated soft drink market continues to grow, especially in single service sizes as consumers look for the convenience and recyclability of bottles made from polyester resins. The lightweight, shatter-resistance, and heat-stability benefits of polyester containers have also increased the demand for bottle-grade resins in containers for noncarbonated beverages and other foods."

Although producers of PET resins are enjoying strong demand for their products, the market is not without its challenges. To sustain long-term growth in use of PET-type containers, producers are under pressure to develop new grades of PET to meet changing packaging needs. At the same time, they are pressed to keep up with demand by investing in capacity expansions. In fact, five companies are slated to bring on more than 1 billion lb of new PET annual capacity by the end of 1996. Persinger calls all of these expansions "essential" and expects that they will keep supply and demand in balance through 1997.

Two months ago, Shell began engineering design work for a possible expansion of its Point Pleasant, W.Va., polyester resins plant. Pending approval by mid-1994, the 165 million-lb-per-year expansion is expected to be completed by the end of 1996, says Persinger. "This expansion is necessary for Shell Chemical to support this market, which is seeing a significant increase in demand for polyester resin."

The Point Pleasant plant, with current capacity of 450 million lb annually, is already in the process of completing another 155 million-lb-per-year expansion slated to go on stream this month. Last year, Shell entered into a long-term agreement under which it could purchase up to 120 million lb per year of precursor bottle resin from Wellman, a plastics manufacturer and recycler based in Shrewsbury, N.J. Shell will begin to purchase the resin in mid-1995 after Wellman starts up a new 160 million-lb-per-year PET resin line at its Darlington, S.C., polyester fiber and resin production facility.

Separately, just last month, Wellman began producing about 80 million lb per year of PET resin for packaging applications at its polyester staple fiber and resin production facility at Darlington. This expansion, planned before the Shell agreement, brings total packaging resin capacity to about 200 million lb per year at the site.

A newcomer to the market, Nan Ya Plastics, a Livingston, N.J.-based subsidiary of Formosa Plastics Group, headquarted in Taipei, Taiwan, plans 238 million lb per year of PET capacity at Lake City, S.C., by August 1995. according to J. S. Tseng, assistant vice president of Nan Ya Plastics.

In addition, two companies are currently building PET plants in Mexico. Although much of the capacity likely will go to supply the growing market for soft drink bottles there and in South America, Persinger expects that about half of the production will be supplied to the U.S. market.

Hoechst Celanese is expected to bring on 150 million lb per year of PET packaging resin capacity at its existing plant at Queretaro, Mexico, during the second quarter of this year. The company targeted Mexico for the plant because it is a high-growth market and one in which Hoechst Celanese is already a major supplier, says Lewis R. Morrison Jr., director of the PET resins business unit within Hoechst Celanese's fibers and film group in Charlotte, N.C.

Sometime in the middle of this year, Eastman Chemical, Kingsport, Tenn., expects to begin construction of a new 140 million-lb-per-year PET bottle polymer plant at the Tereftalatos Mexicanos (Temex) plant site in Cosoleacaque, Veracruz, Mexico. The plant is scheduled to start up in late 1995. East-

Five producers plan to add over 1 billion lb of PET capacity by 1996

Company/location	Annual capacity (millions of lb)	Startup year
Shell Chemical		
Point Pleasant, W.Va.	155	1994
Point Pleasant, W.Va.	165	1996
Eastman Chemical		
Cosoleacaque, Veracruz, Mexico	140	1995
Nan Ya Plastics		
Lake City, S.C.	238	1995
Hoechst Celanese		
Queretaro, Mexico	150	1994
Wellman		
Darlington, S.C.	80	1994
Darlington, S.C.[a]	160	1995

[a] About 120 million lb of precursor bottle resin to be produced for Shell Chemical by Wellman. **Source:** Individual companies

Amoco Chemical's Gupte holds NDC copolyester bottle; others on table are based on PEN.

man and Grupo Industrial Alfa, Temex's majority owner, formed an alliance to bring the project together. Eastman will own the PET plant and will be responsible for its operation; Temex will supply purified terephthalic acid (PTA), the primary raw material for PET, as well as utilities and some services. "With the PET plant located at the Temex site, both companies will gain significant efficiencies," says Harry H. Holliman, vice president and general manager of Eastman's Container Plastics business organization.

Holliman says Eastman's decision to build a PET plant in Mexico was influenced by the potential of the Mexican and other Latin American markets, efficiencies associated with locating at the Temex site, and the improving investment climate in Mexico. Mexico is the world's second largest soft drink market after the U.S. In 1991, the PET refillable soft drink bottle was introduced in Mexico and has enjoyed substantial growth. Eastman has developed a polyester for a refillable bottle and projects that a significant portion of the new plant's output will be directed toward this application throughout Latin America.

It's not hard to see why demand for PET is so strong. Used as a packaging material for soft drink bottles and custom bottles, PET is tough to beat. One of its greatest attributes is that it has a proven track record for being recycled, which is important considering more than 38% of all soft drink bottles and more than 28% of all PET containers were recycled in 1992, according to Persinger. The custom bottle and soft drink bottle markets together are expected to generate growth of 11% or so, representing an increase of 1 billion lb in the five years between 1993 and 1998.

Persinger also expects to see growth in demand for crystallizable PET. Crystallization increases the heat resistance of PET in addition to turning it opaque, making it well suited for use in conventional convection ovens as well as microwave ovens. It also can be handled by high-speed packing and freezing equipment at below –40 °F without breakage. In addition, Shell is developing a low-density crystallizable PET product that will take advantage of PET's performance and reduce costs and weight.

Amorphous PET, which is designed for extrusion into unoriented, clear sheet using conventional thermoplastic extrusion methods, is also quickly becoming the product of choice for drinking cups, deli packaging, and baked goods packing, says Persinger. Crystallizable PET and amorphous PET markets together will grow from about 180 million lb in 1993 to about 300 million lb in 1998, he predicts.

Although PET resins are now used in a number of packaging applications, producers must continue to adapt their product to meet the changing demands of the market. For example, PET producers are facing new challenges resulting from growing demand for 12-, 16-, and 20-oz single service PET bottles, which are smaller than the 2- or 3-L traditional PET bottles. These bottles require faster cycles and very consistent polymer properties at low cost to compete in this highly competitive market. Persinger says Shell is continually improving its proprietary polymer process design to improve resin uniformity.

Much of the long-term growth in PET-type containers lies with the successful development of improved grades for oxygen permeability and thermal stability for hot-fill applications, which is one of the hottest growing packaging segments, says Persinger.

By coupling the latest equipment technology for heat setting with resins designed to set quickly, PET can now be used to package foods filled at up to 190 °F. For example, ketchup is now being packaged in bottles using a small amount of ethylene-vinyl alcohol sandwiched between layers of PET to improve gas barrier resistance by inhibiting oxygen permeation.

In the future, a new monomer called naphthalene dicarboxylate (NDC) will be used in conjunction with PET to produce a polymer with higher barrier and heat resistance. Chicago-based Amoco Chemical is the only company in the world building a commercial facility to produce NDC. Startup is anticipated at its Decatur, Ala., site during the first half of 1995.

NDC can be used to enhance PET's properties two ways, says Janine S. Gupte, product manager for NDC at Amoco Chemical. It can be reacted as a copolymer with dimethyl terephthalate, a possible raw material for PET production, to produce a resin with better barrier and heat resistance properties than PET. And NDC can be polymerized to make polyethylene naphthalate (PEN), which can then be blended with PET to improve PET's properties, she adds.

Currently, Amoco Chemical and Shell Chemical are jointly seeking regulatory clearances for these NDC-based polyesters of commercial interest. In their view, regulatory clearances are a critical milestone for the acceptance of high-performance polyesters in packaging applications.

Gupte says PET producers have been excited about the prospect of buying commercial quantities of NDC, and she anticipates that "in the near future, companies will begin to make serious plans" to use this material to enhance their packaging product portfolios.

Ed Paschke, a research associate at the Amoco Research Center, Naperville, Ill., who has been working with PEN since 1986, says, "PEN extends the limits of polyesters, improving performance for existing applications while making polyesters desirable in entirely new applications." For example, PEN's higher thermal resistance means that a PEN baby food jar could withstand the retort packaging process in which containers are steam sterilized. Because PEN jars are nonbreakable, unlike the glass jars in which baby foods are now packaged, they also eliminate a common safety concern, he says.

If the PET resin market is to continue to enjoy double-digit growth annually, producers will have to face up to significant challenges, Persinger says. "New competition and capacity are entering the U.S. market, but if growth continues as expected, supply and demand should stay in balance. That should help make PET the packaging resin of choice for food, beverages, and other household containers." □